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英文题目: Assessing the Performance of Separate Bias Kalman Filter in Correcting the Model Bias for Estimation of Soil Moisture Profile

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英文摘要: The performance of separate bias Kalman filter (SepKF) in correcting the model bias for the improvement of soil moisture profile is evaluated by assimilating the near-surface soil moisture observations into a land surface model. Firstly, an observing system simulation experiment (OSSE) is carried out, where the true soil moisture is known, two types of model bias (*i.e.*, constant and sinusoidal) are specified and the bias error covariance matrix is assumed to be proportional to the model forecast error covariance matrix with a ratio λ . Secondly, a real assimilation experiment is carried out with the measurements at a site over the Northwest China. In the OSSE, the soil moisture estimate with the SepKF is improved compared with ensemble Kalman filter (EnKF) without the bias filter, because the SepKF can properly correct the model bias, especially in the situation with a large model bias. However, the performance of the SepKF will become slightly worse if the constant model bias increases or the temporal variability of the sinusoidal model bias becomes large. It is suggested that the ratio λ should be increased (decreased) in order to improve the soil moisture estimate if the temporal variability of the sinusoidal model bias becomes high (low). Finally, the assimilation experiment with the real observations also shows that the SepKF can further improve the estimation of soil moisture profile compared with the EnKF without the bias correction.

中文题目: 评估可订正模式偏差的Kalman滤波对土壤湿度的估算

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在同化表层土壤湿度观测估算土壤湿度廓线的框架内, 探究状态和偏差独立更新的 SepKF (separate bias Kalman filter) 同化方法对改进土壤湿度估算和偏差订正的能力。首先, 选取常值与正弦函数偏差模型, 借助观测系统模拟试验(理想试验)并假定偏差误差协方差阵正比于模式预报误差协方差阵, 评估 SepKF 方法在改善土壤湿度估算方面的具体表现; 其次, 利用中国西北地区兰州大学半干旱气候与环境观测站(SACOL)的观测资料, 开展估算土壤湿度廓线的实际试验。理想试验结果表明, SepKF 估算的土壤湿度比不进行偏差订正的 EnKF (ensemble kalman filter) 更好, 原因是它可以部分订正模式偏差, 但是随着常值模式偏差增大或正弦偏差变率由低变为高时, 土壤湿度的改善会降低。偏差协方差阵与模式预报协方差阵的比值大小会影响同化效果, 并建议在高频偏差时增大而在低频时减小该比值。SACOL 站观测的同化试验结果再次表明, SepKF 方法能减轻模式偏差对同化的不利影响, 并提升土壤湿度的估算精度。

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